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Abstract

REACTOR CONTROL SYSTEMS WITH MOVING DETECTORS AND THEIR FURTHER PERSPECTIVES

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Since the beginning of 1958, the development of nuclear reactor control using servomechanism with moving detectors is carried out in Czechoslovakia. Advantages of these systems are as follows:

(a) wide working range
(b) universal applicability
(c) availability for complex automatization of control with simple means.

The principle of function of systems with moving detectors is described for information.

After a principal try-out of these systems and after elaboration of their theory, properties of systems with moving ionization chambers were examined using an experimental installation, that was a prototype of full automatic control system of a reactor. Further, characteristics of servosystems with moving detectors of pulse type were investigated. On the basis of satisfactory results of all investigations, a full automatic control system with moving fission chambers was designed and put into operation during the year 1961 on Czechoslovak research reactor VVR-S. Since the time the system works in normal operation of the reactor up to this time. The device carries out the full automatic check-up on the self-readiness, the start of the reactor to a preset level, power control under both steady and transient states, the continuous check-up on self-correctness and on state of the reactor. Results of its operation confirm expected advantages of systems with moving detectors.

All principal questions for using systems with moving detectors on most of contemporary research reactors are solved now. Technical improvement of their elements must be made. Other problems arise by using these systems on power reactors, where special arrangements must be executed to ensure suitable distribution of neutron flux along the detector channels. Analyses show that advantages of systems with moving detectors are a sufficient reason for additional measures which may ensure physical conditions of operation of these systems of these reactor types, where these conditions are not a natural property of medicine surrounding the reactor core.

In Czechoslovakia now an automatic control system for a heavy water zero power reactor is designed using this principle. The reactor of Czechoslovak first nuclear power station also will be provided with an experimental device of this type in order to obtain an experience of operation in conditions of a large power reactor. In both these cases using of the digital technique is supposed.